

1725
Alw



GJE-5825

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Ian Anthony Jones and Roger Jeremy Wise

Serial No. : 09/806,613 Group : 1725

Filed : March 29, 2001 Examiner: M. Alexandra Elve

For : WELDING METHOD

LETTER SUBMITTING FURTHER COPY OF DOCUMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on OCT 29, 2004

(Date of Deposit)

Sir:

Name of applicant, assignee, or registered rep.

Signature

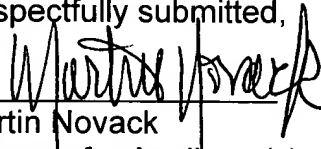
Date

The Office Action dated October 15, 2004, indicates that the document "Iridin LS For The Laser Marking of Plastics", Merck Brochure, June, 1997, is not present in the file. The document was submitted as one of the 46 documents filed with a Supplemental Information Disclosure Statement and Form PTO-1449 that were received at the USPTO on March 4, 2004, as evidenced by a stamped acknowledgement postcard from the USPTO (copy attached). However, since the document is now apparently missing at the USPTO, Applicant submits a further copy

herewith. [For the Examiner's convenience, an informal copy is also being faxed to the Examiner.] It is respectfully requested that the subject document should now be made "of record."

Delray Beach, Florida
Tel. (561) 498-4706
Fax. (561) 498-4027
October 20, 2004

(M-39)

Respectfully submitted,

Martin Novack
Attorney for Applicant(s)



BEST AVAILABLE COPY

COPY

This acknowledges receipt at the PTO, on the date indicated, of

SUPPLEMENTAL INFORMATION
DISCLOSURE STATEMENT (3 sheets);
FORM PTO-1449 (3 sheets); 46 DOCUMENT
COPIES AND 10 TRANSLATIONS
in the following application:

Applicants: Ian Anthony Jones et al

Serial No.: 09/806,613

Filed : March 29, 2001

For : WELDING METHOD

Docket No.: GJE-5825



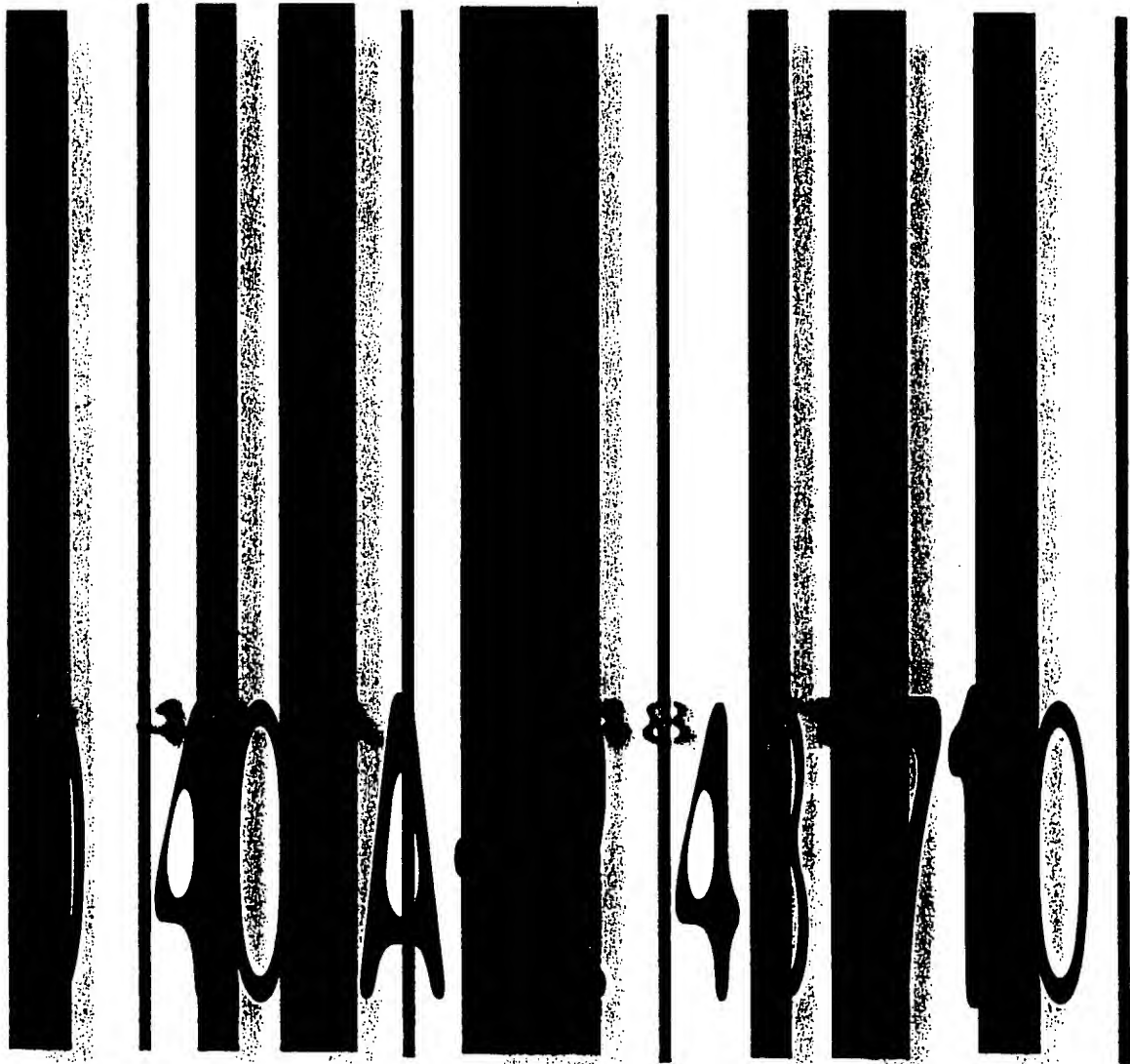
M31

D4

BEST AVAILABLE COPY

Iriodin[®] LS

for the laser marking of plastics



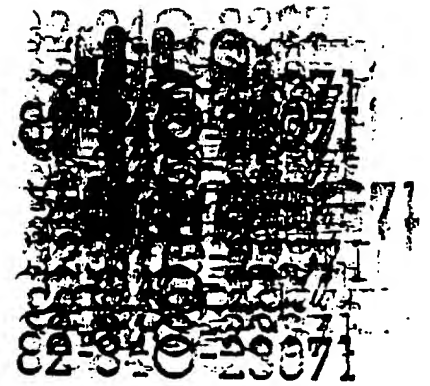
Contents

I	ntroduction	2
L	aser marking of plastics	3
P	roduct range	5
M	arking results	6
P	roperties of laser marking	17
C	ommon methods in the laser marking of plastics	19

Introduction

Today, the marking of manufactured goods has become a standard feature of almost every production process. Hot embossing, printing, punching and engraving are the most commonly used methods of transferring lettering, symbols or decorative features onto the surface of manufactured goods.

The requirements placed on the quality of the appearance of the marking, the marking speed, the environmental compatibility of the method used and its flexibility are continually increasing. At the same time, marking costs should remain as low as possible. These demands are met by a technology which, in recent years, is becoming more and more important in the market:



The marking, coding and lettering with laser beams

The abrasion of printing ink with lasers is the most common application of this technology. The marking is made by the contrast of the printed ink onto the different coloured background. To date, this form of laser labelling has become completely established in many application areas - for example in the beverages industry.

This method does not adequately use a further important advantage of laser marking technology. This is the possibility of making the mark permanent and impossible to forge. For this, the marking must be made directly on or inside the surface of the object to be marked.

In metals, the marking is carried out by laser with a relatively simple engraving on the surface. Markings made in this way are generally more prominent than those made with previous technologies such as mechanical engraving, etching, etc. However, these laser markings are still a long way off from the intensity of a print.

A quality which is comparable with that of a print is often required in the marking of plastics, particularly in the packaging field. Until recently, it was only possible to obtain such a laser marking easily in a few plastics (e.g. PVC). The majority of plastics, e.g. polyolefins, could not be marked by laser or only with inadequate results.

Lasermarking of plastics

The development of laser-markable plastics is a challenge to many companies and indeed, there are special, laser-markable plastic types available on the market. These materials, however, are designed for certain applications and do not offer the large variety of different applications which standart plastics do. In addition they are only available in a few colors. In contrast, completely new perspectives for the laser marking of plastics are opened up if standard plastics, in any colour whatsoever, can be made laser markable.

In this respect, Merck has made a considerable step forward. In close co-operation with laser instrument manufacturers, the continuous development and optimisation of the Iriodin® pigment range have now made the laser marking of many plastics, no matter what colour, possible. Where up to now only insignificant markings were possible, today, clearly contrasted markings are available. For this, Merck has developed a separate product range: the Iriodin® LS types (LS = laser sensitive).

Why can only poorly contrasted markings be made on standard plastics using a laser beam?

Generally, mechanisms which do not cause a strong colour reaction will only produce poorly contrasted lettering which do not even fulfill the minimum legibility requirements.

The main reasons for this are:

a) Transparency of the plastic

The absorption of the plastic is too low for the laser light. Therefore, the laser light goes straight through the plastic without making any substantial changes. A marking is possible after repeated bombardment or at very high laser beam intensities. The stress caused to the material, however, is so high that deep-reaching destruction of the polymer takes place and the marking is still insufficiently clear. The mass production plastics polyethylene, polypropylene and polystyrene are such materials.



*Lasermarked bar codes on PE
with Iriodin® LS 800*

Poor contrasting of the marking

Engraving: There is enough absorption present, but the plastic spontaneously depolymerises under the load. In most plastics, the resulting engraving is too poorly contrasted to serve as an easily legible marking.

Formation of cracks and bubbling

If the laser action leads to the formation of fine cracks or bubbling on the surface, this can indeed lead to a well-contrasted, whitish marking in dark coloured plastics.

Dullness as a result of surface changes caused by melting

Such markings are only visible from certain angles of observation. The contrast is not sufficient for good legibility.

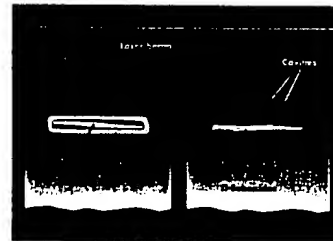
Marking of plastics with contrasting colour reactions

As a general rule, contrasting colour reactions can be provided by chemical reactions in the additives (e.g. colour changes of pigments) or in the polymer matrix (dark colouring due to carbonisation). The important factor in such reactions is that the colours are bright enough and that they are irreversible.

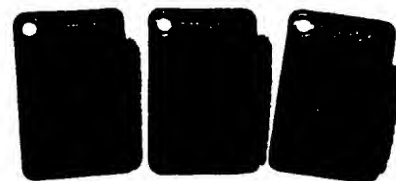
The addition of Iriodin®/Iriodin® LS pigments permits intensive dark or light markings in many plastics under laser treatment. These are caused by a reaction of the polymer and partly also by a reaction in the pigment itself.

Depending on the type of plastic, the pigment and the laser, these markings range from white to black. They are irreversible and avoid an unnecessarily heavy destruction of the polymer because they occur at a relatively low laser intensity in areas near to the surface of the material.

Iriodin®/Iriodin® LS Pigments thus offer the ideal solution for the marking of plastics with laser beams.



Reaction mechanism with Iriodin® pigments hit by a laser beam in plastics



Lasermarked PE with Iriodin® LS 800

Product range

Iriodin® pearl lustre pigments

In the 80's Merck found out that the incorporation of pearlescent pigments, based on mica /TiO₂, in many of the standard plastics make these polymers receptive to the light of a CO₂ laser and a visible mark with good contrast was achievable at a relatively low laser intensity. Iriodin pearl lustre pigments are available in the shining colours silver (100 series), interference (200 series), gold (300 series) as well as copper and bronze (500 series). Pearlescent pigments are commonly known for their decorative enhancement to plastic products and their sensitivity to laser light could now be used as an additional functional capacity.

When laser marking a product is a requirement, but the pearlescent appearance is not necessary or desired, it is possible to cover up the pearl effect with opaque pigments, for example TiO₂, without any negative effect on the lasermarking results.

However a higher loading of opaque pigments has a strong influence on colours and is therefore not recommended for coloured or natural plastics.

For that reason Merck has developed a separate product range particularly designed for the laser marking technology:

The Iriodin® LS pigments (LS-laser sensitive).

The Iriodin® LS pigments offer a lot of advantages in comparison to pearl pigments or special lasermarkable plastics.

Iriodin® LS pigments make possible

- the laser marking of standard plastics
- well-contrasted markings at low laser intensities
- an economic marking due to low pigment concentrations

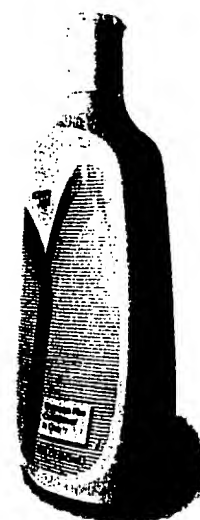
Iriodin® LS pigments are

- simple to mix into the plastic material in several different ways
- can be easily incorporated in existing formulations
- have no important influence on the properties of the material

The following products are available for all laser types which are actually in use for lasermarking plastics:

		Particle size*	Colour	Recommended laser type
Art.no 6825	Iriodin® LS 800	> 15 µm	transparent	CO ₂ Laser
Art.no 4781	Iriodin® LS 805	2-100 µm	transparent	CO ₂ Laser
Art.no 4784	Iriodin® LS 810	2-28 µm	white	CO ₂ Laser
Art.no 4782	Iriodin® LS 820	< 15 µm	light grey	Nd: YAG
Art.no 4783	Iriodin® LS 825	< 15 µm	transparent- blue grey	Nd: YAG
Art.no 4779	Iriodin® LS 830	10-60 µm	black	all laser types
Art.no 4786	Iriodin® LS 835	< 15 µm	black	all laser types
Art.no 4785	Iriodin® LS 850	< 15 µm	blue	all laser types

* Iriodin® pigments are thin platelets. The above particle sizes refer to platelet diameter.



Lasermarked HDPE bottle with Iriodin®

Marking results

The marking results which are obtainable depend on the following factors:

- plastic type
- type of laser
- Iriodin®/ Iriodin® LS type

The most suitable Iriodin®/Iriodin® LS type and the optimum pigment concentration must be determined. The presence of other additives in the formulation, such as colorants and fillers, can affect the marking results although the plastics remain markable in most cases (exception: carbon black at > 0.2 %, as explained later under black plastics).



*Lasermarked
HDPE bottle
with Iriodin®*

Marking results Polyethylene

CO₂ - mask laser

• Natural material

Recommended Iriodin® LS type:

Iriodin® LS 800 or Iriodin® LS 805

Recommended concentration:

0,1 - 0,3 % to the existing formulation

Colour of the marking:

dark

General aspects:

Iriodin LS 800 as well Iriodin LS 805 are totally transparent. Therefore the addition show no negative influence on the original colour.

• White material

Recommended Iriodin® LS type:

Iriodin® LS 810

Recommended concentration:

0,1 - 0,5 % to the existing formulation

Colour of the marking:

dark

General aspects:

Iriodin® LS 810 is a whitish transparent pigment which shows an improved marking behavior in comparison to Iriodin® LS 800 or Iriodin® LS 805. Especially in low density polyethylene Iriodin® LS 800 offers an ideal way to achieve dark markings of high contrast.

• Coloured material

Recommended Iriodin® LS type:

Iriodin® LS 800 / Iriodin® LS 805 or Iriodin® LS 810

Recommended concentration:

0,1 - 1 % to the existing formulation

Colour of the marking:

depending on the concentration dark or whitish

General aspects:

Due to the transparency of Iriodin® LS 800 and Iriodin LS 805 they are suitable to be added to existing formulations without changing the original colour of the formulation. By adding concentrations up to 0,3 % the markings are dark. The further addition up to 1 % lead to markings which are more and more whitish. Those markings are of high contrast, especially on dark formulations. Iriodin LS 810 can be used to replace small amounts of TiO₂ of the original formulation to achieve dark markings in e.g. low density polyethylene.

LDPE deo sticks with
Iriodin® LS marked by a
CO₂ mask laser.



Black material

Recommended Iriodin® LS type:

Iriodin® LS 830 or LS 835

Recommended concentration:

0,2 - 1 % depending to the hiding power requested
whitish

Colour of the marking:

General aspects:

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior.

ALL TEST
0 1 2 3 4 5 6 7 8 9



Nd: YAG laser

Natural, white and coloured material

Recommended Iriodin® LS type:

Iriodin® LS 820 or Iriodin® LS 825

Recommended concentration:

0,1 - 0,3 % to the existing formulation

Colour of the marking:

dark

General aspects:

Iriodin® LS 820 as well Iriodin® LS 825 show a very low colour impact. Therefore the addition show nearly no influence on the original colour.

Lasermarked PE with
Iriodin® LS 810 (white) and
Iriodin® LS 850 (dark blue)

Black material

Recommended Iriodin® LS type:

Iriodin® LS 830 or LS 835

Recommended concentration:

0,2 - 1 % depending to the hiding power requested
whitish

Colour of the marking:

General aspects:

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior.

Marking results Polypropylene

CO₂ - mask laser

Natural material

Recommended Iriodin® LS type:

Iriodin® LS 800 / Iriodin® LS 805 or LS 810

Recommended concentration:

0,1 - 0,3 % to the existing formulation

Colour of the marking:

whitish or dark

General aspects:

Iriodin® LS 800 as well Iriodin® LS 805 are totally transparent. Therefore the addition show no negative influence on the original colour. The markings are whitish with a good contrast. For dark markings Iriodin® LS 810 should be used, however there is a certain influence on the transparency.

White material

Recommended Iriodin® LS type:

Iriodin® LS 810

Recommended concentration:

0,1 - 0,5 % to the existing formulation

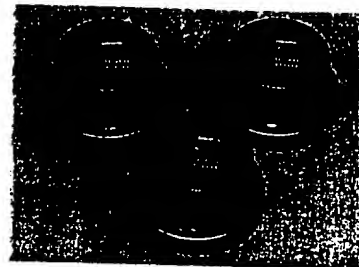
Colour of the marking:

dark

General aspects:

Iriodin® LS 810 is a whitish transparent pigment which shows an improved marking behavior in comparison to Iriodin® LS 800 or Iriodin® LS 805.

*Lasermarked PP Lids with
Iriodin® LS 830*



Coloured material

Recommended Iriodin® LS type:

Iriodin® LS 800 / Iriodin® LS 805 or Iriodin® LS 810

Recommended concentration:

0,1 - 1 % to the existing formulation

Colour of the marking:

depending on the concentration dark or whitish

General aspects:

Due to the transparency of Iriodin® LS 800 and Iriodin® LS 805 they are suitable to be added to existing formulations without changing the original colour of the formulation. By adding concentrations up to 0,3 % the markings are whitish. Those markings are of high contrast, especially on dark formulations. Iriodin® LS 810 can be used to replace small amounts of TiO_2 of the original formulation to achieve dark markings.

Black material

Recommended Iriodin® LS type:

Iriodin® LS 830 or LS 835

Recommended concentration:

0,2 - 1 % depending to the hiding power requested

Colour of the marking:

whitish

General aspects:

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior.

Nd: YAG laser

Natural, white and coloured material

Recommended Iriodin® LS type:

Iriodin® LS 820 or Iriodin® LS 825

Recommended concentration:

0,1 - 0,3 % to the existing formulation

Colour of the marking:

dark

General aspects:

Iriodin® LS 820 as well Iriodin® LS 825 show a very low colour impact. Therefore the addition show nearly no influence on the original colour.

Black material

Recommended Iriodin® LS type:

Iriodin® LS 830 or LS 835

Recommended concentration:

0,2 - 1 % depending to the hiding power requested

Colour of the marking:

whitish

General aspects:

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior.

Marking results Polystyrene

CO₂ - mask laser

Natural material

Recommended Iriodin® LS type:

Iriodin® LS 800 or Iriodin® LS 805

Recommended concentration:

0,1 - 0,3 % to the existing formulation

Colour of the marking:

white

General aspects:

Iriodin® LS 800 as well Iriodin® LS 805 are totally transparent. Therefore the addition show no negative influence on the original colour.

White material

Recommended Iriodin® LS type:

Iriodin® LS 810

Recommended concentration:

0,1 - 0,5 % to the existing formulation

Colour of the marking:

grey

General aspects:

Iriodin® LS 810 is a whitish transparent pigment which shows an improved marking behavior in comparison to Iriodin® LS 800 or Iriodin® LS 805.

Coloured material

Recommended Iriodin® LS type:

Iriodin® LS 800 / Iriodin® LS 805 or Iriodin® LS 810

Recommended concentration:

0,1 - 1 % to the existing formulation

Colour of the marking:

depending on the concentration dark or whitish

General aspects:

Due to the transparency of Iriodin® LS 800 and Iriodin® LS 805 they are suitable to be added to existing formulations without changing the original colour of the formulation. By adding concentrations up to 0,3 % the markings are dark. The further addition up to 1 % lead to markings which are more and more whitish. Those markings are of high contrast, especially on dark formulations. Iriodin® LS 810 can be used to replace small amounts of TiO₂ of the original formulation to achieve dark markings.

Black material

Recommended Iriodin® LS type:

Iriodin® LS 830 or LS 835

Recommended concentration:

0,2 - 1 % depending to the hiding power requested

Colour of the marking:

whitish

General aspects:

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior.

Nd: YAG laser

• Natural, white and coloured material

<i>Recommended Iriodin® LS type:</i>	Iriodin® LS 820 or Iriodin® LS 825
<i>Recommended concentration:</i>	0,1 - 0,3 % to the existing formulation
<i>Colour of the marking:</i>	dark
<i>General aspects:</i>	Iriodin® LS 820 as well Iriodin® LS 825 show a very low colour impact. Therefore the addition show nearly no influence on the original colour. Polystyrene in general marks well with the Nd:YAG laser. The addition of Iriodin® LS 820 or Iriodin® LS 825 increase the sensibility of the material. The advantages are higher marking speed, better definition of the markings, better surface quality of the marking as well as lower laser energy needed.

• Black material

<i>Recommended Iriodin® LS type:</i>	Iriodin® LS 830 or LS 835
<i>Recommended concentration:</i>	0,2 - 1 % depending to the hiding power requested
<i>Colour of the marking:</i>	whitish
<i>General aspects:</i>	To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior. Due to the fact that polystyrene marks black in general two marking mechanisms take place at the same time. A dark marking from the material itself, as well as a whitish marking caused by Iriodin® LS 830 or Iriodin® LS 835.

Marking results in PET

CO₂ - mask laser

• Natural material

<i>Recommended Iriodin® LS type:</i>	Iriodin® LS 800 or Iriodin® LS 805
<i>Recommended concentration:</i>	0,1 - 0,3 % to the existing formulation
<i>Colour of the marking:</i>	white
<i>General aspects:</i>	Iriodin® LS 800 as well Iriodin® LS 805 are totally transparent. Therefore the addition show no negative influence on the original colour.

• White material

<i>Recommended Iriodin® LS type:</i>	Iriodin® LS 800 or LS 805
<i>Recommended concentration:</i>	0,1 - 0,3 % to the existing formulation
<i>Colour of the marking:</i>	white
<i>General aspects:</i>	Unfortunately it is not possible to achieve dark markings on white PET.



Lasermarked PET plastic plates
with Iriodin® LS 800 (right)
and without (left)

• Coloured material

Recommended Iriodin® LS type:

Iriodin® LS 800 or Iriodin® LS 805

Recommended concentration:

0,1 - 3 % to the existing formulation

Colour of the marking:

white

General aspects:

Due to the transparency of Iriodin® LS 800 and Iriodin® LS 805 they are suitable to be added to existing formulations without changing the original colour of the formulation. By adding concentrations up to 0,3 % the markings are white and show good contrast on coloured materials.

• Black material

Recommended Iriodin® LS type:

Iriodin® LS 830 or LS 835

Recommended concentration:

0,2 - 1 % depending to the hiding power requested

Colour of the marking:

whitish

General aspects:

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior.

Nd: YAG laser

• Natural, white and coloured material

Recommended Iriodin® LS type:

Iriodin® LS 820 or Iriodin® LS 825

Recommended concentration:

0,1 - 0,3 % to the existing formulation

Colour of the marking:

dark

General aspects:

Iriodin® LS 820 as well Iriodin® LS 825 show a very low colour impact. Therefore the addition show nearly no influence on the original colour. PET in general marks well with the Nd:YAG laser. The addition of Iriodin® LS 820 or Iriodin® LS 825 increase the sensibility of the material. The advantages are higher marking speed, better definition of the markings, better surface quality of the marking as well as lower laser energy needed.

• Black material

Recommended Iriodin® LS type:

Iriodin® LS 830 or LS 835

Recommended concentration:

0,2 - 1 % depending to the hiding power requested

Colour of the marking:

whitish

General aspects:

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior. Due to the fact that polystyrene marks black in general two marking mechanisms take place at the same time. A dark marking from the material itself, as well as a whitish marking caused by Iriodin® LS 830 or Iriodin® LS 835.

Marking results Polycarbonate

CO₂ - mask laser

Natural material

<i>Recommended Iriodin® LS type:</i>	Iriodin® LS 800 or Iriodin® LS 805
<i>Recommended concentration:</i>	0,1 - 0,5 % to the existing formulation
<i>Colour of the marking:</i>	dark
<i>General aspects:</i>	Iriodin® LS 800 as well Iriodin® LS 805 are totally transparent. Therefore the addition show no negative influence on the original colour.

White material

<i>Recommended Iriodin® LS type:</i>	Iriodin® LS 810
<i>Recommended concentration:</i>	0,1 - 0,5 % to the existing formulation
<i>Colour of the marking:</i>	dark
<i>General aspects:</i>	Iriodin® LS 810 is a whitish transparent pigment which shows an improved marking behavior in comparison to Iriodin® LS 800 or Iriodin® LS 805.

Coloured material

<i>Recommended Iriodin® LS type:</i>	Iriodin® LS 800 or Iriodin® LS 805
<i>Recommended concentration:</i>	0,1 - 3 % to the existing formulation
<i>Colour of the marking:</i>	dark
<i>General aspects:</i>	Due to the transparency of Iriodin® LS 800 and Iriodin® LS 805 they are suitable to be added to existing formulations without changing the original colour of the formulation. By adding concentrations up to 0,3 % the markings show dark markings on coloured materials.

Black material

<i>Recommended Iriodin® LS type:</i>	Iriodin® LS 830 or LS 835
<i>Recommended concentration:</i>	0,2 - 1 % depending to the hiding power requested
<i>Colour of the marking:</i>	whitish
<i>General aspects:</i>	To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior.

Nd: YAG laser

Natural, white and coloured material

<i>Recommended Iriodin® LS type:</i>	Iriodin® LS 820 or Iriodin® LS 825
<i>Recommended concentration:</i>	0,1 - 0,3 % to the existing formulation
<i>Colour of the marking:</i>	dark
<i>General aspects:</i>	Iriodin® LS 820 as well Iriodin® LS 825 show a very low colour impact. Therefore the addition show nearly no influence on the original colour. Polycarbonate in general marks well with the Nd:YAG laser. The addition of Iriodin® LS 820 or Iriodin® LS 825 increase the sensibility of the material. The advantages are higher marking speed, better definition of the markings, better surface quality of the marking as well as lower laser energy needed.

Black material

Recommended Iriodin® LS type:

Recommended concentration:

Colour of the marking:

General aspects:

Iriodin® LS 830 or LS 835

0,2 - 1 % depending to the hiding power requested
whitish

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior. Due to the fact that polycarbonate marks black in general two marking mechanisms take place at the same time. A dark marking from the material itself, as well as a whitish marking caused by Iriodin® LS 830 or Iriodin® LS 835.

Marking results ABS

CO₂ - mask laser

• Natural material

Recommended Iriodin® LS type:

Recommended concentration:

Colour of the marking:

General aspects:

Iriodin® LS 800 or Iriodin® LS 805

0,1 - 0,5 % to the existing formulation
dark

Iriodin® LS 800 as well Iriodin® LS 805 are totally transparent.

Therefore the addition show no negative influence on the original colour.

• White material

Recommended Iriodin® LS type:

Recommended concentration:

Colour of the marking:

General aspects:

Iriodin® LS 810

0,1 - 0,5 % to the existing formulation
dark

Iriodin® LS 810 is a whitish transparent pigment which shows an improved marking behavior in comparison to Iriodin® LS 800 or Iriodin® LS 805.

• Coloured material

Recommended Iriodin® LS type:

Recommended concentration:

Colour of the marking:

General aspects:

Iriodin® LS 800 or Iriodin® LS 805

0,1 - 0,3 % to the existing formulation
dark

Due to the transparency of Iriodin® LS 800 and Iriodin® LS 805 they are suitable to be added to existing formulations without changing the original colour of the formulation. By adding concentrations up to 0,3 % the markings show dark markings on coloured materials.



Lasermarked PUR cattle tags with Iriodin® LS 820

Black material

Recommended Iridin® LS type:

Iridin® LS 830 or LS 835

Recommended concentration:

0,2 - 1 % depending to the hiding power requested

Colour of the marking:

whitish

General aspects:

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iridin® LS 830 and Iridin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior.

Nd: YAG laser

➤ Natural, white and coloured material

Recommended Iridin® LS type:

Iridin® LS 820 or Iridin® LS 825

Recommended concentration:

0,1 - 0,3 % to the existing formulation

Colour of the marking:

dark

General aspects:

Iridin® LS 820 as well Iridin® LS 825 show a very low colour impact. Therefore the addition show nearly no influence on the original colour. ABS in general marks well with the Nd:YAG laser. The addition of Iridin® LS 820 or Iridin® LS 825 increase the sensibility of the material. The advantages are higher marking speed, better definition of the markings, better surface quality of the marking as well as lower laser energy needed.

➤ Black material

Recommended Iridin® LS type:

Iridin® LS 830 or LS 835

Recommended concentration:

0,2 - 1 % depending to the hiding power requested

Colour of the marking:

whitish

General aspects:

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iridin® LS 830 and Iridin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior. Due to the fact that polycarbonate marks black in general two marking mechanisms take place at the same time. A dark marking from the material itself, as well as a whitish marking caused by Iridin® LS 830 or Iridin® LS 835.



Labeling of electronic housings by Nd:YAG laser

Marking results Polyamide

CO₂ - mask laser

▣ Natural material

Recommended Iriodin® LS type:

Iriodin® LS 800 or Iriodin® LS 805

Recommended concentration:

0,1 - 0,5 % to the existing formulation

Colour of the marking:

white

General aspects:

Iriodin® LS 800 as well Iriodin® LS 805 are totally transparent.

Therefore the addition show no negative influence on the original colour.

▣ White material

Recommended Iriodin® LS type:

Iriodin® LS 800 or Iriodin® LS 805

Recommended concentration:

0,1 - 0,3 % to the existing formulation

Colour of the marking:

white

General aspects:

Unfortunately it is not possible to achieve dark markings on polyamide.

▣ Coloured material

Recommended Iriodin® LS type:

Iriodin® LS 800 or Iriodin® LS 805

Recommended concentration:

0,1 - 3 % to the existing formulation

Colour of the marking:

white

General aspects:

Due to the transparency of Iriodin® LS 800 and Iriodin® LS 805 they are suitable to be added to existing formulations without changing the original colour of the formulation. By adding concentrations up to 0,3 % the markings show white markings on coloured materials.

▣ Black material

Recommended Iriodin® LS type:

Iriodin® LS 830 or LS 835

Recommended concentration:

0,2 - 1 % depending to the hiding power requested

Colour of the marking:

whitish

General aspects:

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior.



Labeling of
electronic housings
by Nd:YAG laser

Nd: YAG laser

▣ Natural, white and coloured material

Recommended Iriodin® LS type:

Iriodin® LS 820 or Iriodin® LS 825

Recommended concentration:

0,1 - 0,3 % to the existing formulation

Colour of the marking:

dark

General aspects:

Iriodin® LS 820 as well Iriodin® LS 825 show a very low colour impact.

Therefore the addition show nearly no influence on the original colour.

• Coloured material

Recommended Iriodin® LS type:

Recommended concentration:

Colour of the marking:

General aspects:

Iriodin® LS 820 or Iriodin® LS 825 and Iriodin® LS 800

0,25 % (LS 825) and 0,8% Iriodin® LS 800 to the existing formulation

white

By using a combination of Iriodin® LS 820 or Iriodin® LS 825 together with Iriodin® LS 800 it is possible to achieve white markings with high contrast. In reinforced materials the concentration of the pigment should be increased. The relation should be approx. 1:4 (e.g. 0,4% Iriodin® LS 825 and 1,6% Iriodin® LS 800).

• Black material

Recommended Iriodin® LS type:

Recommended concentration:

Colour of the marking:

General aspects:

Iriodin® LS 830 or LS 835

0,2 - 1 % depending to the hiding power requested

whitish

To achieve whitish markings on a black material first tests should be done starting from a natural material. Iriodin® LS 830 and Iriodin® LS 835 are black pigments which give the colour as well as the lasermarkability to the material. Combination with small amounts of black carbon (max. 0,1 %) are possible. Higher loadings of black carbon may have a negative influence on the marking behavior. Due to the fact that polycarbonate marks black in general two marking mechanisms take place at the same time. A dark marking from the material itself, as well as a whitish marking caused by Iriodin® LS 830 or Iriodin® LS 835.



*LDPE deo stick
marked with CO₂-mask laser*

Properties of laser marking

The lettering, coding and marking of products with a laser beam in industrial production satisfies in every respect the highest demands. The advantages of laser marking are due to the special features of this technology:

Laser marking is carried out:

without contact

- a high marking throughput without mechanical abrasion
- clean, sharply edged markings, also on soft, irregular or curved surfaces
- very small lettering in excellent quality

inkless

- permanent, solvent-, wipe- and scratchproof markings
- no problems with combustible, volatile solvents and their disposal
- clean coding technology without expensive consumption materials

at very high speed

- sharp edged marking on moving objects with exact positioning of the mark
- up to 6,000 markings a minute with a pulse TEA-CO₂ laser
- up to 2,000 mm/sec with an Nd:YAG laser

very flexible, because

- can be programmed by software
- automatic mask changer
- very small lettering (0.5 mm character height) and line widths available
- very high resolution of the marking



PE bottle with Iridin[®] marked by a DOT Matrix laser



Lasermarked PE plastics with Iridin[®] LS 800

Cleaner:
Store at room temp.
Toll Free No.
Call: 1-800-
Research & Lab.
Instruments of B.
O. Research & Lab.
Instruments
Research & Lab.
Personal Products
Research & Lab.
Order No. 621



Lasermarked plastic label (Multi-layer polyolefine) with Iridin[®]

without previous treatment of the surface

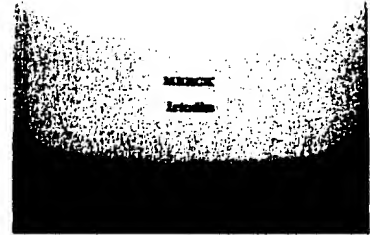
no adhesion problems, also when marking on polyethylene and polypropylene
marking is made in and not on the plastic
the presence of a wet coating on the surface has no negative effect on the marking

very economic, because

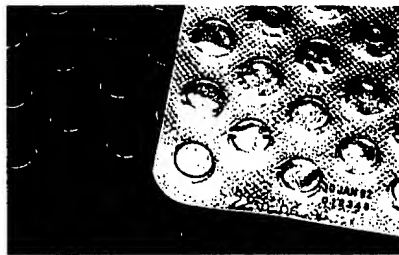
minimum servicing requirements
no consumption materials
fully automated coding
the laser is quickly amortised

impossible to forge

permanent markings which cannot be removed without leaving clear signs of manipulation
ideal for safety coding
wipeproof due to the alteration of the material surface (penetration depth 20 - 200 μm)



*Lasermarked PE bottle with
Iriodin® LS 810*



*Lasermarked transparent PP blister films with
Iriodin® LS 800*

Common methods in the laser marking of plastics

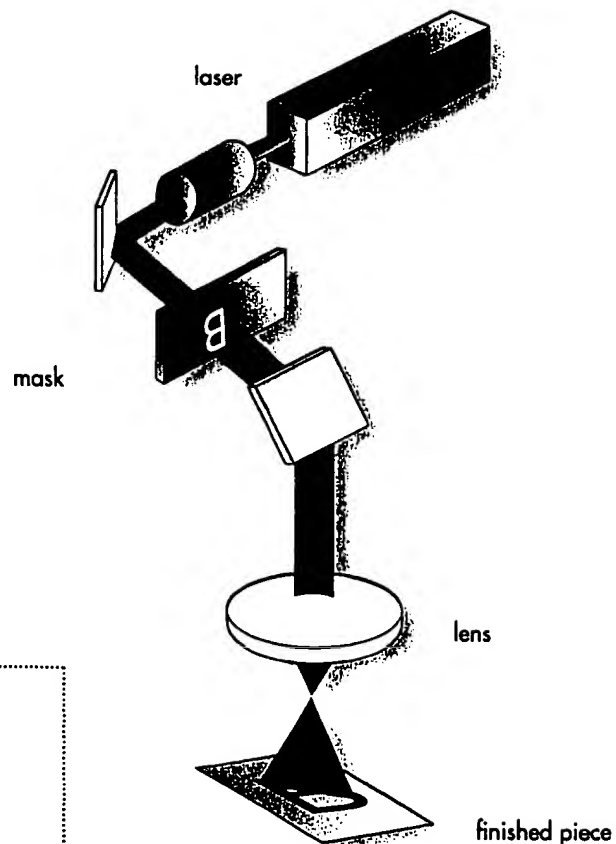
Depending on the type of material, the nature and purpose of the lettering and the marking speed, three different methods can be chosen

- masking method
- beam deflection method
- continuous beam method

The mask- and beam deflection methods are by far the most commonly applied technologies. The continuous beam method is only used in extreme cases, e.g., in marking metals, and can be discounted here.

Mask method

In the masking method, the extremely short impulse of light energy is directed on the position to be marked. A metal mask in the paths of the beam contains the letters, numbers or signs which are to be marked. The picture of the mask on the object is made using a lens. The energy density of the light rays (in J/cm^2) is increased depending on the scale of the marking.



Schematic building of a mask system

These are:

- pulsed TEA-CO₂ laser (wavelength 10,6 mm)
- Excimer laser (wavelength 193 - 351 nm)
- pulse Nd:YAG laser (wavelength 1064 nm)

Among the CO₂ lasers, the so-called dot-matrix lasers are a special case. The images they produce are similar to the print of an ink jet printer.

Pulsed TEA-CO₂ laser (TEA = Transversal Excited Atmospheric Pressure)

Pulse TEA-CO₂ lasers, at a pulse length of only a few nanoseconds, cause carbonisation and therefore a change in the colour of the plastic surrounding the pigment. This carbonisation only takes place near the pigment particles at the surface of the object. The total stability of the material remains unchanged. In many cases, the pigment itself darkens. Plastics which have little tendency to carbonise undergo bubbling on the surface. Carbonisation and bubbling can take place simultaneously where the result is a light-grey marking.

Depending on the pigment concentration, the type of plastic used and the laser energy, carbonisation or bubbling can be created as required. The result is the choice of either light or dark marking. Experience has shown that low pigment concentrations (from 0.1 %) provide a dark marking and that higher concentrations (up to 1.5 %) show a light coloured marking. There is a gradual change from dark to light. Here though, the black colouring reaches a maximum. The optimum pigment concentrations to provide a well-contrasted marking at an economical price should be determined by experiment.

The following table shows the results of trials to establish the limit



*Lasermar-
ked HDPE-
shampoo
bottle with
Iriodin®*

values for energy density which are required to mark various plastics. The gradation of energy density was 3.7 and 11 J/cm². The individual plastics were pigmented with 0.5 % Iriodin® LS 810.

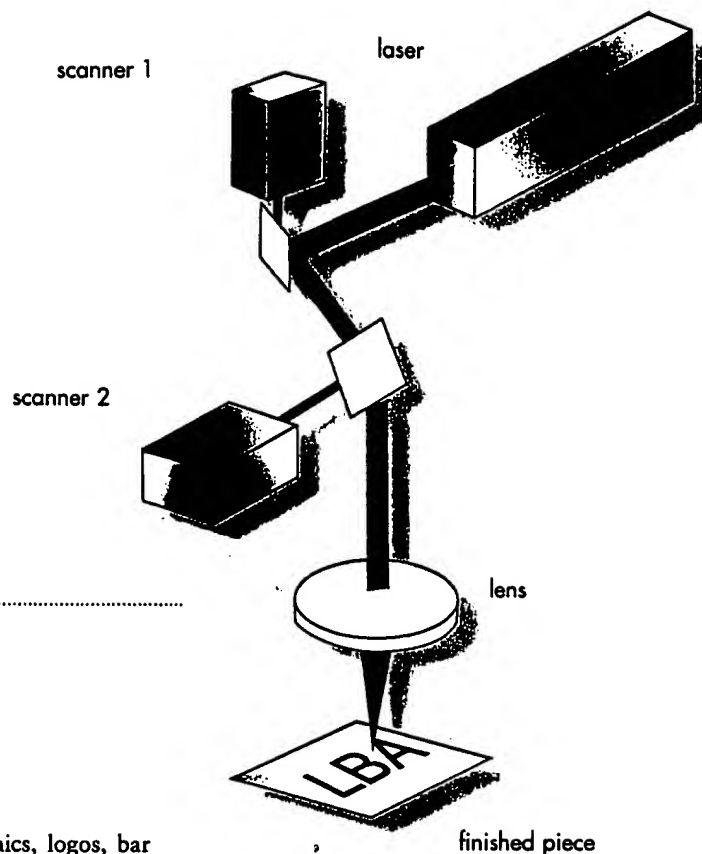
plastic	visible marking	easily legible marking
epoxy resin	7J/cm ²	—
PE	<3J/cm ²	3J/cm ²
PP	3J/cm ²	7J/cm ²
PS	<3J/cm ²	3J/cm ²
ABS	<3J/cm ²	3J/cm ²
PET	7J/cm ²	11J/cm ²
PVC	3J/cm ²	7J/cm ²
PC	<3J/cm ²	3J/cm ²

Without pigmenting, only PVC from about 7 J/cm² displays a yellowish brown, clearly visible marking and epoxy resin displays a weak, poorly contrasted engraving. All other plastics could not be marked within the test range. In comparison with other substances which were examined for laser marking with CO₂ lasers, such as Kaolin, Iriodin® pigments could be used with a very low limit value and gave a better contrasted marking. In practice, this means that the laser can be used at a higher pulse frequency thus providing a larger throughput on the production line.

Beam deflection method

In the beam deflection method, the laser is directed via two galvanometer mirrors and a lens system to the object to be marked. Using special software, a computer controls the galvanometer mirror. The marking is made by directing the beam in directions x and y. The beam deflection method is very flexible and can transmit a high density of information.

Schematic building of scanner system



The complete contents of the marking with texts, graphics, logos, bar codes, etc., are prepared on the computer. Therefore, there is no need to manufacture and change additional lettering apparatus (masks, punches, engravers, etc.). Beam deflection is not as fast, however, as the mask marking method with a small information content.

The laser types used are:

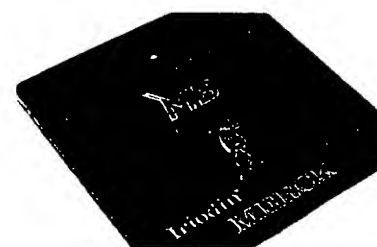
1. Nd:YAG laser with 532 and 1064 nm wavelength

2. CW-CO₂ laser (= continuous wave)

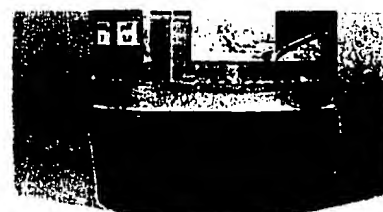
In the CW-CO₂ laser, the energy charge is a constant flow and has no energy peaks necessary for carbonisation. The plastic is just melted without leaving an adequately contrasted marking.

3. Dot-matrix (CO₂ laser)

The dot matrix method is a special form of the radiation deflection method. Here the beam is only deflected on one plane and the second plane is determined by the speed of the object passing the marking head. This method does not always provide optimum results.



Lasermarked PE plate containing Iridin® LS 850 (Nd: YAG laser)



Lasermarked bottle base with Iridin® LS 800

Comparison of mask and beam deflection methods

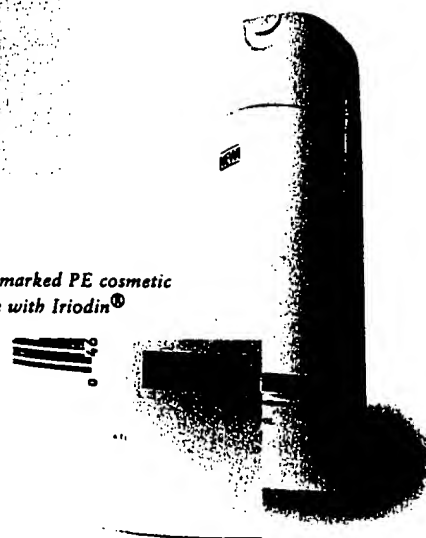
In table 2, the mask and beam deflection methods are compared using typical laser marking systems.

	Maskmarking	Scannermarking
Laser type	CO ₂	Nd:YAG
inscription size (mm)	10x20	Ø 150 ^b
strength of marking (mm)		
min.	0,05	0,02
max.	10	10
size of characters (mm)		
min.	0,5	0,1
max.	10	100
speed of inscription	up to 50 signs/s	
speed of article marking (m/s)	up to 50	up to 5
cost of investment	+	-
simplicity	+	-
speed of inscription	++	+
inscription size/area	-	++
quality of inscription	-	++
flexibility	-	++

a) Option Ø 120 mm

b) Options Ø 230 mm, 280 mm

Lasermarked PE cosmetic
bottle with Iriodin®



Merck-the company

Merck operates worldwide. Apart from the German Merck company and Merck AG in Zug, Switzerland, it also includes the Lipha group. We have our own companies in 47 countries and 65 production facilities in 28 countries. Worldwide, more than 25,000 employees work for the group.

The Merck product range includes more than 15,000 different articles in the fields of chemistry, pharmaceuticals, diagnostics as well as technical products.

Merck KGaA is divided into the divisions; Pharmaceuticals, Laboratory, (reagents and diagnostic agents), Fine chemicals, Pigments and Cosmetics.

The Pigments and Cosmetics Division supplies products for colour and lustre effects and also many service activities to our customers in the printing-, ceramic-, plastic- and coating industries.

For cosmetic manufacturers, we supply products for decorative cosmetics, sun protection, self-tanning and skin care.

Our research, which is oriented to the needs of our customers, and the environmental compatibility of our products are the most important criteria of success in all business fields.

We advise our customers regarding technical applications to the best of our knowledge within the scope of the possibilities open to us, but without obligation. Current laws and regulations must be observed at all times. This also applies in respect of any protected rights of third parties. Our suggestions do not relieve our customers of the necessity to test our products, on their own responsibility, for suitability for the purpose envisaged. Quotations from our literature are only permitted with our written authority, and the source must be stated.

Merck-group worldwide



This brochure provides an overview of the application and processing possibilities for Iriodin® and Iriodin® LS for laser marking in different plastics. It provides general information. We shall be pleased to put our decades of experience with Iriodin® pigments at your service if you have more detailed questions. In our laboratories for plastics, equipped with the most modern apparatus, we also investigate individual application problems. Here, we can count on our excellent cooperation with all the world's leading masterbatch and laser manufacturers with whom we jointly search for ways to improve your products.

Published by: Merck KGaA
Frankfurter Straße 250
64293 Darmstadt
Tel.: 0 61 51/72 61 33
Fax: 0 61 51/72 76 84
Photos: Tobias Feld
Layout: Böhm und Nonnen
Litho: Blöink Reprotechnik
Print: EK-Offset, Riedstadt
Juni 1997

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☒ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☒ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☒ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.